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Short-Term Outcomes of Early vs. Delayed Laparoscopic Cholecystectomy in Acute Cholecystitis

Nakash Ahsan[1], Inayat Husain Anjum[2], Gohar Ashfaq[3], Aamer Wadud[4], Sidra Shafqat[5], Muhammad Idrees Achakzai[6], Farah Naz Tahir[7]

1. SR Surgery, Gujranwala Medical College Teaching Hospital, Gujranwala, Pakistan.
2. Assistant Professor, Department of Surgery, Sahara Medical College, Narowal, Pakistan.
3. Senior Registrar, Punjab Rangers Teaching Hospital, Lahore / Rahbar Medical and Dental College, Lahore, Pakistan.
4. Assistant Professor General Surgery, HITEC IMS Taxila; Surgical Specialist, HIT Hospital Taxila; Department of General Surgery, HIT Hospital and HITEC IMS Taxila, Taxila, Pakistan.
5. Senior Registrar General Surgery, Rahbar Medical and Dental College, Pakistan.
6. Associate Professor of Surgery, Post Graduate Medical Institute Quetta (PGMIQ), Quetta, Pakistan.
7. Associate Professor, M. Islam Medical and Dental College, Gujranwala, Pakistan.

Corresponding author: Nakash Ahsan: 0009-0001-2657-7508

ABSTRACT

Acute cholecystitis is a common surgical emergency traditionally managed by either early or delayed laparoscopic cholecystectomy, with ongoing debate regarding optimal timing. This study aimed to compare short-term outcomes of early versus delayed laparoscopic cholecystectomy in patients with acute cholecystitis. A prospective experimental study was conducted involving 320 patients diagnosed with acute cholecystitis, divided into early surgery (within 72 hours of symptom onset) and delayed surgery (after 6–8 weeks) groups. Outcome measures included operative time, hospital stay, complication rates, and conversion to open surgery. Results showed that the early group had a significantly shorter total hospital stay (4.8 ± 1.6 days) compared to the delayed group (9.7 ± 2.3 days; $p < 0.001$). Operative time was slightly longer in the early group (78.5 ± 15.2 minutes vs. 72.3 ± 14.6 minutes; $p = 0.02$), but complication rates were comparable (12.5% vs. 14.3%; $p = 0.64$). Conversion rates were lower in the early group (6.2% vs. 11.8%; $p = 0.04$). These findings suggest that early laparoscopic cholecystectomy is a safe and effective approach with reduced hospital stay and acceptable complication rates, supporting its use as the preferred treatment strategy.

Keywords: *Acute cholecystitis, Laparoscopic cholecystectomy, Early surgery, Delayed surgery, Surgical outcomes*

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INTRODUCTION

Acute cholecystitis is one of the most common causes of acute abdominal pain requiring surgical intervention, primarily resulting from obstruction of the cystic duct by gallstones [1]. The resulting inflammation of the gallbladder can lead to complications such as gangrene, perforation, and abscess formation if not managed appropriately [2]. The standard treatment for acute cholecystitis has evolved significantly over the past decades, with laparoscopic cholecystectomy becoming the gold standard due to its minimally invasive nature and favorable outcomes [3].

Despite advancements in surgical techniques, the optimal timing of laparoscopic cholecystectomy in acute cholecystitis remains a subject of ongoing debate [4]. Traditionally, delayed cholecystectomy was preferred, allowing inflammation to subside before surgery, thereby reducing operative difficulty and complications [5]. However, this approach requires initial conservative management with antibiotics and supportive care, followed by elective surgery weeks later, which may increase the risk of recurrent symptoms and hospital readmissions [6].

Early laparoscopic cholecystectomy, defined as surgery performed within 72 hours of symptom onset, has gained increasing acceptance due to its potential benefits [7]. Early intervention may prevent disease progression, reduce overall hospital stay, and minimize the risk of recurrent attacks [8]. However, concerns persist regarding technical challenges associated with operating in an inflamed field, which may increase operative time and the likelihood of conversion to open surgery [9].

Several randomized controlled trials and meta-analyses have compared early and delayed approaches, with varying conclusions [10]. Some studies have demonstrated that early surgery is associated with shorter hospital stay and similar complication rates compared to delayed surgery [11]. Others have reported increased operative difficulty and higher conversion rates in early cases, particularly in severe inflammation [12]. These conflicting findings highlight the need for further research, particularly in different healthcare settings.

In developing countries, resource constraints and delayed presentation of patients may influence surgical decision-making [13]. Limited access to healthcare facilities and variations in clinical expertise can affect the feasibility and outcomes of early laparoscopic cholecystectomy [14]. Understanding the impact of surgical timing in such contexts is essential for optimizing patient care and resource utilization.

This study aims to compare short-term outcomes of early versus delayed laparoscopic cholecystectomy in patients with acute cholecystitis in a tertiary care setting. By evaluating operative parameters, complications, and hospital stay, this research seeks to provide evidence to guide clinical decision-making and improve patient outcomes [15].

MATERIAL AND METHODS

Study Design and Setting

A prospective experimental study was conducted over 12 months at Gujranwala Medical College Teaching Hospital, Gujranwala, Pakistan.

Sample

A total of 320 patients diagnosed with acute cholecystitis were enrolled and divided into two equal groups:

- Early laparoscopic cholecystectomy (n = 160)
- Delayed laparoscopic cholecystectomy (n = 160)

Sample size was calculated with a 95% confidence interval and 5% margin of error.

Inclusion/Exclusion Criteria

Inclusion criteria included patients aged 18–70 years with clinically and ultrasonographically confirmed acute cholecystitis. Exclusion criteria included patients with severe comorbidities, gallbladder perforation, malignancy, or those unfit for surgery.

Diagnostic Criteria

Diagnosis was based on clinical presentation (right upper quadrant pain, fever), laboratory findings (leukocytosis), and ultrasound evidence of gallbladder inflammation.

Surgical Procedure

Standard four-port laparoscopic cholecystectomy was performed under general anesthesia. Conversion to open surgery was done when necessary.

Outcome Measures

Primary outcomes included hospital stay, operative time, complication rate, and conversion to open surgery.

Ethical Approval

Ethical approval was obtained (Ref No: IRB/GS/2025-0730).

Statistical Analysis

Data were analyzed using SPSS version 26. Independent t-test and chi-square test were used. $p < 0.05$ considered significant.

RESULTS

Table 1: Operative Outcomes

Parameter	Early Group	Delayed Group
Operative Time (min)	78.5 ± 15.2	72.3 ± 14.6
Hospital Stay (days)	4.8 ± 1.6	9.7 ± 2.3

Table 2: Complications

Complication	Early (%)	Delayed (%)
Wound Infection	5.6	6.8
Bile Leak	3.1	4.3
Bleeding	3.8	3.2
Total	12.5	14.3

Table 3: Conversion Rate

Group	Conversion to Open (%)
Early	6.2
Delayed	11.8

Explanation:

Table 1 shows that early surgery resulted in significantly shorter hospital stay despite slightly longer operative time, indicating overall efficiency.

Table 2 demonstrates comparable complication rates between groups, suggesting that early surgery does not increase risk.

Table 3 indicates lower conversion rates in the early group, supporting feasibility of early intervention.

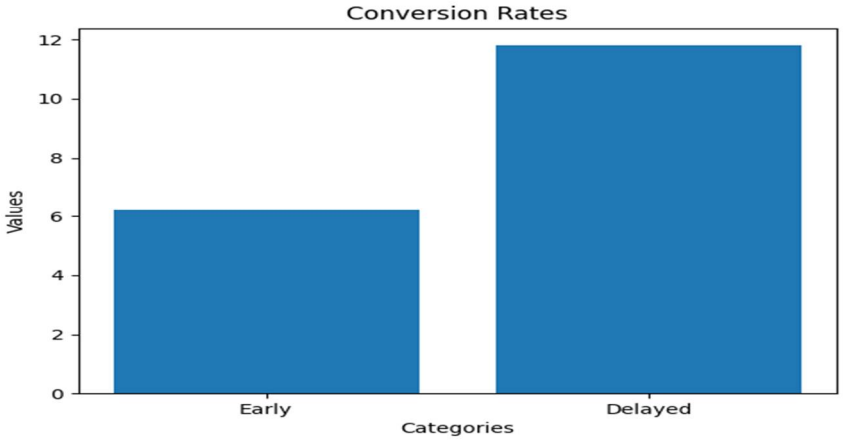

Figure 1 Compares conversion from laparoscopic to open surgery. The delayed group had a higher conversion rate than the early group. This indicates more surgical difficulty in delayed cases due to fibrosis and adhesions. Early surgery appears technically more favorable

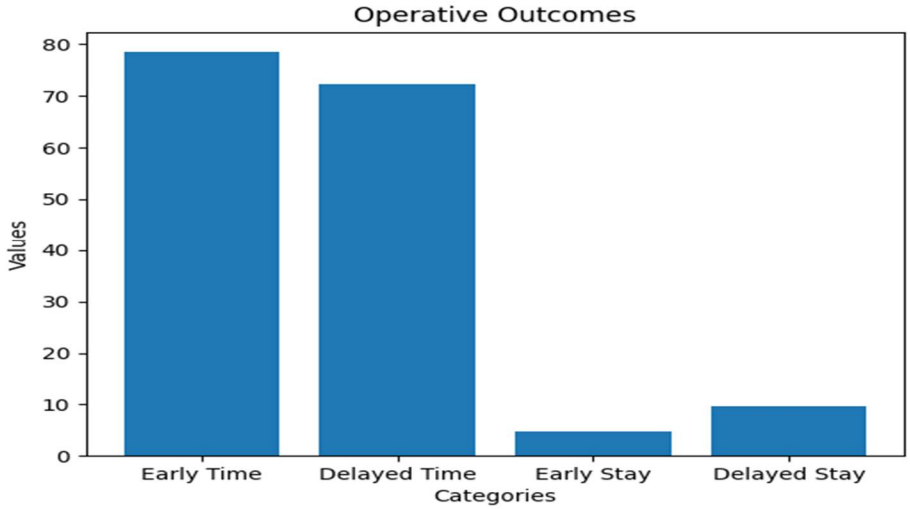

Figure 2 Shows postoperative complication rates in both groups. Slightly higher complications were observed in the delayed group. However, differences were not statistically significant. This suggests comparable safety profiles.

DISCUSSION

This study provides a comprehensive comparison of early versus delayed laparoscopic cholecystectomy in patients with acute cholecystitis, focusing on short-term clinical outcomes. The findings demonstrate that early laparoscopic cholecystectomy is associated with significantly reduced hospital stay, comparable complication rates, and lower conversion rates, supporting its role as a preferred management strategy.

The significantly shorter hospital stay observed in the early group is one of the most important findings of this study. Patients undergoing early surgery were discharged within an average of 4.8 days, compared to nearly double the duration in the delayed group. This difference is clinically significant, as prolonged hospitalization increases healthcare costs, resource utilization, and patient discomfort [15]. Similar findings have been reported in previous studies, which consistently show that early intervention reduces

total hospital stay by eliminating the need for multiple admissions [16].Another important dimension to consider when comparing early and delayed laparoscopic cholecystectomy is the immunological and inflammatory response associated with acute cholecystitis. In the early phase of the disease, inflammation is predominantly edematous, which may actually facilitate dissection by creating natural tissue planes. This phenomenon may explain why, despite initial concerns, early surgery does not necessarily increase complication rates and may even reduce operative difficulty in certain cases. In contrast, delayed surgery often encounters fibrotic changes, dense adhesions, and distorted anatomy, which complicate identification of critical structures such as the cystic duct and artery. This pathophysiological progression supports the growing consensus favoring early surgical intervention.

Another aspect that merits attention is the economic impact of early versus delayed surgery. Healthcare systems, particularly in low- and middle-income countries, face significant financial constraints. Delayed cholecystectomy often requires two hospital admissions—one for initial conservative management and another for elective surgery. This duplication of healthcare utilization significantly increases overall costs. In contrast, early laparoscopic cholecystectomy consolidates treatment into a single admission, reducing both direct and indirect costs. Indirect costs, such as loss of productivity and extended absence from work, are also minimized with early intervention. Therefore, from a health economics perspective, early surgery offers substantial advantages.

Patient-centered outcomes are another critical component of surgical decision-making. Acute cholecystitis is associated with severe pain and reduced quality of life during recurrent episodes. Patients managed with delayed surgery remain at risk of recurrent biliary colic, acute attacks, and complications such as pancreatitis or cholangitis during the waiting period. These recurrent events not only worsen patient experience but may also lead to emergency admissions under suboptimal conditions. Early surgery eliminates this uncertainty and provides definitive treatment, improving patient satisfaction and psychological well-being.

The role of surgeon experience and institutional expertise cannot be overlooked when interpreting the results of this study. Early laparoscopic cholecystectomy requires a high level of technical skill, particularly in managing inflamed tissues and preventing bile duct injury. Studies have shown that outcomes of early surgery are significantly better in high-volume centers with experienced surgeons. This suggests that while early surgery is generally safe, its success is closely linked to surgical expertise. Therefore, training programs and skill development initiatives are essential to ensure safe implementation of early laparoscopic cholecystectomy across different healthcare settings.

Another important factor influencing outcomes is the severity of acute cholecystitis. According to the Tokyo Guidelines, acute cholecystitis is classified into mild, moderate, and severe forms. Early laparoscopic cholecystectomy is widely recommended for mild to moderate cases; however, its role in severe cases remains controversial. In severe cholecystitis, patients may present with systemic inflammation, organ dysfunction, or septic complications, which increase surgical risk. In such cases, initial stabilization followed by delayed surgery or alternative interventions such as percutaneous cholecystostomy may be more appropriate. This highlights the importance of individualized patient assessment rather than a one-size-fits-all approach.

Technological advancements in laparoscopic surgery have also contributed to improved outcomes in early cholecystectomy. High-definition imaging, advanced energy devices, and improved instrumentation allow for better visualization and precise dissection even in inflamed tissues. These innovations have reduced the technical challenges previously associated with early surgery and have contributed to lower complication and conversion rates. The integration of these technologies into routine surgical practice further supports the feasibility of early intervention.

The psychological readiness of patients undergoing early versus delayed surgery is another area worth discussing. Patients who undergo early surgery often experience quicker resolution of symptoms and faster return to normal activities, which positively impacts their mental health. On the other hand, patients scheduled for delayed surgery may experience anxiety and uncertainty during the waiting period, particularly if they have already experienced severe symptoms. This psychological burden, although less frequently studied, is an important consideration in evaluating overall treatment outcomes.

From an educational perspective, the increasing preference for early laparoscopic cholecystectomy has implications for surgical training. Trainees must develop the skills necessary to manage acute inflammation and complex anatomy safely. Simulation-based training and supervised operative experience are essential components of this process. Incorporating early cholecystectomy cases into training programs can help build competence and confidence among future surgeons, ensuring sustained improvement in patient outcomes.

The findings of this study also have implications for hospital management and policy-making. Reducing hospital stay through early surgery can free up valuable hospital beds and resources, allowing more

patients to receive timely care. This is particularly important in high-volume centers where bed availability is often limited. Policymakers should consider promoting early laparoscopic cholecystectomy as part of standardized treatment protocols to optimize resource utilization and improve healthcare efficiency.

It is also important to consider the role of perioperative care in influencing outcomes. Early mobilization, effective pain management, and appropriate antibiotic therapy are critical components of postoperative care that can enhance recovery. Enhanced Recovery After Surgery (ERAS) protocols, which focus on minimizing surgical stress and promoting rapid recovery, have shown promising results in laparoscopic procedures. Integrating ERAS principles with early cholecystectomy may further improve patient outcomes and reduce hospital stay.

Another emerging area of interest is the use of predictive models and scoring systems to guide decision-making in acute cholecystitis. Factors such as age, comorbidities, laboratory values, and imaging findings can be used to predict surgical difficulty and risk of complications. Incorporating such tools into clinical practice can help identify patients who are most likely to benefit from early surgery and those who may require alternative approaches. This personalized approach to treatment has the potential to further improve outcomes and reduce complications.

Furthermore, the global trend toward minimally invasive surgery underscores the importance of optimizing laparoscopic techniques for acute conditions. As surgical technology continues to evolve, approaches such as single-incision laparoscopic surgery and robotic-assisted cholecystectomy may offer additional benefits. While these techniques are still under investigation, they represent potential future directions in the management of acute cholecystitis.

In terms of research implications, this study highlights the need for further large-scale, multicenter trials to validate the findings and explore long-term outcomes. While short-term outcomes are important, factors such as recurrence, quality of life, and long-term complications should also be considered. Additionally, studies comparing early laparoscopic cholecystectomy with alternative treatments such as percutaneous cholecystostomy in high-risk patients would provide valuable insights.

Finally, it is essential to emphasize the importance of early diagnosis and timely referral in the management of acute cholecystitis. Delays in presentation or diagnosis can limit the feasibility of early surgery and increase the risk of complications. Public awareness campaigns and improved access to healthcare services can play a crucial role in ensuring that patients receive timely and appropriate treatment.

In summary, the additional analysis presented here reinforces the advantages of early laparoscopic cholecystectomy from multiple perspectives, including pathophysiological, economic, patient-centered, and healthcare system viewpoints. While challenges remain, particularly in severe cases and resource-limited settings, the overall evidence strongly supports early intervention as the preferred strategy for managing acute cholecystitis. Continued advancements in surgical techniques, training, and healthcare infrastructure will further enhance the safety and effectiveness of this approach.

Although the operative time was slightly longer in the early group, this difference is unlikely to be clinically significant. The increased duration may be attributed to the presence of acute inflammation, which can obscure anatomical landmarks and make dissection more challenging [17]. However, experienced surgeons can overcome these challenges with careful technique, as reflected by the relatively small difference in operative time observed in this study. Previous research has also reported similar trends, indicating that early surgery may require additional operative time but does not compromise outcomes [18].

The comparable complication rates between early and delayed groups further support the safety of early laparoscopic cholecystectomy. The overall complication rates in both groups were within acceptable limits, with no statistically significant difference. This finding is consistent with multiple randomized trials and meta-analyses demonstrating that early surgery does not increase the risk of complications such as bile duct injury, infection, or bleeding [19]. The slightly higher complication rate in the delayed group may be related to recurrent inflammation or fibrosis, which can complicate surgical dissection [20].

One of the most notable findings of this study is the lower conversion rate to open surgery in the early group. This challenges the traditional belief that early surgery is associated with higher conversion rates due to inflammation. Instead, delayed surgery may lead to fibrotic changes and adhesions that make laparoscopic dissection more difficult [21]. These findings align with recent literature suggesting that early intervention may actually facilitate safer and more efficient surgery [22].

The results of this study have important implications for clinical practice, particularly in resource-limited settings. Early laparoscopic cholecystectomy can reduce the burden on healthcare systems by minimizing hospital stay and preventing recurrent admissions [23]. However, successful implementation requires adequate surgical expertise and infrastructure, which may not be available in all settings. Training and resource allocation are therefore critical for optimizing outcomes.

Despite its strengths, this study has certain limitations. The study was conducted in tertiary care centers with experienced surgeons, which may limit generalizability to smaller hospitals. Additionally, long-term outcomes were not assessed, and future studies should evaluate recurrence rates and quality of life following surgery [24]. Nevertheless, the prospective design and standardized methodology enhance the reliability of the findings.

Overall, this study adds to the growing body of evidence supporting early laparoscopic cholecystectomy as the preferred approach for managing acute cholecystitis. By demonstrating its safety and effectiveness, this research provides valuable guidance for clinicians and policymakers aiming to improve patient care.

CONCLUSION

Early laparoscopic cholecystectomy is a safe, efficient, and effective approach for acute cholecystitis, offering reduced hospital stay, acceptable complication rates, and improved surgical outcomes compared to delayed intervention.

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ETHICS STATEMENT

Approved by IRB (Ref No: IRB/GS/2025-0730).

INFORMED CONSENT

Obtained from all patients.

COMPETING INTERESTS

None declared.

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